



FACT SHEET

Module 9

Changing Traction Conditions

Vehicle Balance and Traction Loss

Vehicle Balance Concepts:

Vehicle suspension, geometry, and tire pressure are basic components of balance when at rest.

When vehicle is in motion:

- Sudden steering, braking, and/or acceleration change vehicle balance and traction dramatically.
- Sudden loss of vehicle balance causes traction loss.
- Traction loss compounds crash results.

When brakes are applied to vehicle:

- Weight or center of mass transfers to the front of the vehicle.
- This causes a noticeable drop of the hood and a rise of the rear deck.
- Occupants feel forward movement.

When acceleration is applied to the vehicle:

- Weight or center of mass transfers to the rear of the vehicle.
- This causes a noticeable rise of the hood and drop of the rear deck.
- Occupants feel rearward movement.

When steering is applied:

- Weight or center of mass to the front right or left of the vehicle.
- This causes a noticeable drop and tilt of the hood and a rise and tilt of the rear deck.
- Occupants feel movement forward toward the corner of the vehicle.

Key to vehicle operation:

- Smooth and efficient steering, braking, and accelerator movements.
- Any abrupt movements or changes of the vehicle are transferred to the vehicle suspension and have a significant affect on the balance of the vehicle.

Traction Concerns

Traction: Traction or adhesion is the grip between the tires and the road surface that allows a vehicle to start, stop, and/or change direction. Three types of traction influence the control/or movement of a motor vehicle. They are: **Stationary (static), rolling (dynamic), and sliding.**

A stationary vehicle parked on a flat surface with its brakes set is an example of static traction. It has greatest resistance to movement. There is greater traction between a stationary wheel and the road than there is between a sliding wheel and the road. Sliding traction does not grip the road as well as static traction.

There is more traction between a rolling wheel and the road than there is between a sliding wheel and the road. This is why a driver needs to keep the wheels rolling and not lock the brakes when trying to steer or stop a vehicle.

Traction between the tires and the road does not remain constant. For example, sand, gravel or water on the road decrease the level of traction. As speed increases, traction between the tires and the road decreases. With decreased traction, the possibility of skidding or sliding increases.

Detecting Traction Loss

The first indication of traction loss should be motion-based sensory stimuli generated by vehicle movements and body tensions away from intended path of travel. By the time a driver is visually aware that the rear or front of the vehicle is not headed in the desired direction (or sliding rather than stopping), the situation is typically more difficult to correct.

Early movement detection begins with proper seating, safety belt snug, left foot on dead pedal, and grasping the steering wheel with both hands in a balanced position. This seating position allows the vehicle to more readily communicate changes in motion to the driver.

When seated in this manner, employing an aggressive visual search to detect conditions that could reduce available traction should require minor corrections of accelerator, brake, or steering wheel to bring the vehicle back to the intended path of travel if it moves away from the targeted path of travel.



Having failed to detect early warning signals, how do you respond? **While there is no one way to handle a traction loss**, there are guidelines that can be applied to help change sliding traction into rolling traction.

Basic guidelines include:

- **Determine which tires (front or rear) have changed** from rolling traction to sliding traction.
- **Visually target an open path of travel.** Do not look at the object toward which you are sliding.
- **Release sudden inputs** of steering, accelerator, or brake pedal (whichever has caused the traction change) to regain vehicle balance to neutral.
- **Steer toward open path of travel** as long as vehicle is in motion.
- **In case of front wheel change to sliding traction**, jabbing the brake may be necessary to reestablish rolling traction.
- **In case of rear wheel change to sliding traction**, progressive acceleration (target speed of 2 mph) may aid in regaining rear wheel rolling traction which helps to regain steering control.

If the vehicle is sliding sideways on the roadway, it follows the same basic principles as the front wheel loss of traction to regain control. Establishing vision to the targeted path of travel is critical to regain some steering control with the front tires. The vehicle will then take on characteristics of front or rear loss of traction as rolling traction is established to the front tires.

Identifying and Responding to Front Wheel Loss of Traction

Front wheel loss of traction, termed understeer, occurs when the steering wheels move from rolling traction to sliding traction. It typically occurs on a slippery surface when trying to steer a vehicle through a curve or around a corner. It also may occur as a result of approaching a curve or turning too fast and braking hard or suddenly providing too much steering input. The traction loss may be more subtle and is identified visually when the front of the vehicle moves outward away from the travel path, even though the driver continues to turn toward the path of travel. The driver's vision picks up the movement straight ahead, instead of through the curve or around the corner. Since the tires are designed to go straight ahead, if the wheels are turned too sharply or abruptly, the sidewalls tend to roll under and the smooth sidewall rather than the tire tread makes contact with the road.

Turning force cannot be developed from the sliding traction. At the same time, the rolling rear wheels push to keep the vehicle moving in a straight line.

If the driver locks the brakes while attempting to steer around an obstacle, the vehicle simply skids into whatever he was attempting to avoid. It is critical that the driver direct his vision to the targeted path of travel and not to the skid path. Release the pedal, brake or accelerator, so the weight of the vehicle lets the tires reform from the sidewall to the tread and reestablish rolling traction. Ease off the steering. Jab the brake to shift some weight to the front of the vehicle

if the vehicle does not respond to the path of travel. The steering will respond quickly when rolling traction regains, so be prepared for a sudden movement of the vehicle toward the planned path of travel.

Responding to Front Wheel Traction Loss

Look for an open path of travel and release the accelerator or brake pedal to regain vehicle balance and rolling traction to front wheels.

How Should You Steer?

Having identified a visual target, path of travel, turn the steering wheel in the direction you want the vehicle to go. This may take small readjustments as the vehicle responds to your initial steering input, especially in a front tire traction loss. Fast steering wheel movement produces more sliding traction or less rolling traction as the tire sidewall moves sideways. The key is not to steer more than necessary to keep the vehicle directed toward your path of travel.

Identifying and Responding to Rear Wheel Loss of Traction

Rear wheel loss of traction, termed oversteer, occurs when rolling traction moves to sliding traction on the rear wheels of the vehicle. In this skid, unless corrective action is initiated quickly, the tires with less traction try to move to the front and the vehicle's natural tendency is to rotate 180 degrees and end up going backward. As with front wheel loss of traction, rear wheel traction loss may occur on a slippery surface when trying to steer a vehicle through a curve or around a corner. It also may occur as a result of approaching a curve or turning too fast and braking hard, suddenly providing too much steering input or acceleration.

On a slippery surface, the driver should recognize rear wheel loss of traction when observing that the front of the vehicle is moving to the left or right away from the targeted path of travel, even though he/ she is not steering the vehicle in that direction. The best response is to keep targeting path of travel, ease off the brake or accelerator, continually steer toward the travel path, and use a very light and progressive acceleration as the rear of the vehicle recovers from sliding to rolling traction.

The key to this problem is to keep targeting the travel lane and not the side of the road and to steer back to the lane. At this point of the slide or skid the driver may not have steered enough to regain his path of travel, so he may have to increase steering inputs until rolling traction begins to help. This is where light and progressive acceleration can transfer weight and help rolling traction return from rear tire sliding traction.

Responding to Rear Wheel Traction Loss

Look for an open path of travel and release the accelerator or brake pedal to regain vehicle balance and rolling traction to front wheels.

How Should You Steer?

Having identified a visual target, path of travel, turn the steering wheel in the direction you want the vehicle to go. This may take some rapid readjustments as the vehicle responds to your initial steering input, especially in a rear tire traction loss. Lateral forces in a rear wheel traction loss also will affect the movement of the vehicle.

Lateral acceleration is the sideways movement of the vehicle and is determined by how fast the steering wheel is turned and the momentum of the vehicle. Fast steering wheel movement produces more side or lateral acceleration. The key is not to steer more than necessary to keep the vehicle directed toward your path of travel. When the vehicle stops moving in one direction, this energy will want to quickly move in the opposite direction; so being able to respond with the steering wheel demands constant attention until the vehicle is safely back on the desired path of travel.